# SUPPLEMENT.


# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

**FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.**

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## Original Correspondence.

### WORKING MEN'S RIGHTS AND DUTIES.

Sir,—More events almost, if not altogether, of hopeful augury for the best interests of working men have taken place this year than in the preceding quarter of a century, and many that the most sanguine optimist could hardly have dreamed possible in the space of time. Dismissing, first, the leaven of ignorance and re-action, inevitably attendants in all great movements, the International Congress at Basle will deserve small notice. Every meeting of this body only serves to make more palpably clear the crass absurdities of their socialistic theories. When workmen sign a bond engaging not to use whatever talents or good conduct they may be blessed with for the advantage of themselves and their families, but to remain content with the fate of the lowest, and most unworthy, of their body without any effort to emerge from such a degraded position, surely socialism has been pushed to its last limit. We cannot, therefore, be surprised at any wild abuse of all in any way better off than themselves, or any amount of distrust or rejection of the kindly help other classes are so able, and often so willing, to extend to them from its disciples. There were it is true some amongst them in advance of the rest on some points, and the English delegate (I forget whether called Armitage or Applegarth), though far behind the leaders of our working men here was amongst the Gothamites at Basle a very Triton amongst the minnows—almost the only man showing any glimmerings of insight into the logical results of the nonsense they were gravely talking. I shall wait with some curiosity to see in what time this social "talking thing" will talk itself out, or "whereunto it will grow."

But it must in fairness be confessed that in some cases, with all our superior experience and wisdom, we in England now and then give sad proof how hard men are to be taught, where they fancy the lesson opposed to their interests. Nor is this confined to the operative classes. If the lath-renders show this short-sightedness by agitating for restrictions on the import of foreign laths, some of the manufacturing masters in Manchester—the very cradle of free trade—keep them in countenance by complaining of the French Treaty as one-sided, because it did not load foreign manufactures with such duties as would protect English trade. Of course these are merely a fraction, bearing a very small proportion to those who can see that where our manufacturing industry has swelled to such gigantic proportions, nothing but free trade can enlarge the circle of our customers to take off the produce of our continually increasing machinery. The cotton supply, which is now a famine, would have amply sufficed for the consumption a few years back; and prices of cotton must in time give way before the increasing produce, stimulated by the large profits of the growers. Meantime, it may be feared hard times may have to be passed through by many manufacturers. But this cannot be helped; the evils of over-production of goods must be left to cure themselves, and would only in the end be intensified by any attempt to tamper with the natural course of supply and demand by protective duties of any kind. Emigration—especially to our own colonies, and the enrichment of India by the golden harvest now received there for cotton, will do all that can be done to bring up demand to the enormously increased supply, by increasing the number of consumers, and this process is going on rapidly. All extension that can possibly be given to it is substantial and prompt relief to all our manufacturing producers, both masters and men, and the only effectual relief they can hope for.

At Birmingham, Bristol, and Liverpool many utterances of some of the leading men amongst us are full of practical good sense, well worth the attentive study of the working class, and proving the active sympathy of the upper crust of society in all concerning their welfare. Of this there can be no doubt when bishops take their part in the movement, showing how deeply and ably they have studied the important question how to secure for our workers all the advantages attainable in our present state of society. Let us sum up a few results of these interesting discussions, almost universally admitted by all speakers of any note. The advantage of Trades Unions, properly managed, for securing to the workmen fair wages and conditions of labour, seems now fully conceded. But Lord Stanley ably showed the absolute necessity for sound trade knowledge and wisdom in their leaders, by demonstrating in what way their action may in the end, when ill-advised, damage the very cause they are aiming for, by injuring the employment which is the only source whence sufficient wages can be paid. Every word he said is worthy of the most careful thought of all working men who have heads upon their shoulders. The mournful history of the destruction of the London shipbuilding business is a sad comment on these truths. The Rev. Canon Girdlestone was, as he has ever been, the zealous, able friend of agricultural labourers, proving the utter impossibility of comfortable existence on their average wages in many of the southern counties, and that to talk of any improvement in their condition until they were better paid was nothing but unfeeling mockery. I was sorry to read some attempts to show that quantities of beer and cyder given in some districts, and 2s. a week parish allowance in winter, were substantial benefits to eke out the pitifully low wages in many cases. The speakers, from their position, ought to have known that both modes of payment for work entitled to fair remuneration are degrading and demoralising to the labourer, sapping his self-restraint and feelings of independence, and tending to make it all but impossible for him to make any effort to better his condition. However, it is a comfort to find that the Rev. Canon's irresistible facts and logic all but silenced these cavillers, and convinced his hearers. The remedies he proposed—the formation of committees to diffuse information as to the wages obtainable in different localities, to equalise the rate by removals from the worse paid districts, and education of the children to raise them from the stolid apathy of their parents—are eminently practical, and he could appeal to the good he had already done by removing 150 families from semi-starvation to comfortable subsistence.

I regret to see the *Times*, warped by the interest of Mr. Walter in the farmers' attempts to get their labour at as low a rate as possible, devoting a pretty long leader to attempts to refute the Rev. Canon's conclusions, and to prove that the degraded position of too many agricultural labourers does not arise from insufficient wages. Unable to refute the facts and inferences marshalled in overwhelming force by the worthy Canon, the writer of this review veils the real question in a cloud of sophistry, admitting that the farm labourers are at the bottom of the social scale, but denying that the evils he enumerates would be remedied by raising their wages to an amount sufficient to enable them to live comfortably with their families. Therefore, he conclues that the Canon's removal of ill-paid labour to districts where wages are higher will not, upon the whole, do any good, and that the farm labourer is doomed to remain as he is. Divested of the mass of words and false issues by which this conclusion is perplexed and entangled, its absurdity, when plainly and nakedly stated, is too palpable to need any refutation. Passing on to other views of Trade Unions, all their exercise of coercion and intimidation in every form was denounced by every speaker at all these gatherings with an emphatic unanimity which should convince the leading men amongst the Unionists, if anything can convince them, that the old days of terrorism are past, never to return, and that the country will not tolerate any sort of oppression to force men to join Trades Unions, or to obey their mandates. The sooner this is accepted as an irrevocable fact, and acted upon by all concerned, the greater will be the influence of these Unions in every way. On the other hand, the doctrine of a policy of conciliation and settling trade disputes by arbitration, if needed, or agreement between masters and men, is daily giving increased power as an acting principle. In this direction the managers of Trades Unions must move, if they wish to retain their power and be of any use. Mr. Kettle and Mr. Mundella are doing good service in this best mode of settling trade disputes. The amicable solution of the Middlesborough colliers' strike by an improved, fairer mode of allowance for waste, which, whilst fair to the men, sufficiently protects the masters, shows how much good may be done by cool, able leaders on both sides seeking the best mode of settling any difference. In mournful contrast to this wisdom is the deplorable miners' strike at Averyron, ending in wild riot and a long list of killed and wounded by the soldiers called in to restore order. Surely our French neighbours will see how much they may learn from us in the best way of getting for working men what they are fairly entitled to.

The extension of co-operation seemed to me more hopefully relied upon by many speakers than I fear will be realised by the result. By all means let those try it who, looking into both sides of the matter, see what they think good reason to expect it will benefit them. But it can only have perfect success in certain exceptional cases of a rare combination of ability and integrity, and will never be adopted upon a scale to affect the relations of workmen as a body towards their employers. Therefore, the working men should not let their attention be diverted from their continual attempts to improve their condition as workmen, and remove their grievances, by the illusive hope that they can as a class become something else.

At these meetings the improvement of workmen's dwellings was advocated (principally those of farm labourers), but the subject hardly received the prominent notice its importance merits. The removal of temptations to drunkenness, by improving the condition of the working class, and providing them with healthy amusements and recreation, was warmly advocated by some dignitaries of the church in a kind, genial, catholic spirit of Christian duty and common sense, which was truly refreshing. Where so much was well and wisely said at all these gatherings it may seem almost invidious to notice omissions and failures. But the sanitary conditions of employment, or taking the utmost care of the health of men in their work, that every occupation admits of, and the vitally important necessity of keeping up the skill and excellence of our work, as the only means of retaining our lead in arts and manufactures undamaged by foreign competition, were all but wholly unnoticed. Yet both these subjects form one chief part of the duties of well-ordered Trades Unions. So much healthy progress, however, has recently been made, and is making, that we may confidently hope England will not long hang behind in care of these matters.

A Man of Experience.

*London, Oct.* 11.

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### CO-OPERATION v. ARBITRATION.

Sir,—The address of Lord Stanley, delivered in Liverpool last week, on the occasion of an industrial co-operation association being opened in that town, has once again brought the whole labour question prominently before the country. Fortunately the subject comes before us in a more favourable aspect and in a more practical form than it has hitherto assumed. The old Broadhead principles of Trades Unionism and terrorism are now universally scouted and condemned, and physical force will not again, I trust, be arrayed and brought into open contact with those just rights which belong to large employers and large capitalists. Only a few years since, if the demands of the workmen (whether just or not) were not at once conceded, Trades Unions did not hesitate to recommend the most wanton acts of violence and mischief. The Royal Commission which investigated so patiently and efficiently these Trades Unions brought the machinations of Broadhead and his *confreres* to light, and no sooner was this the case than such attrocities were repudiated by the working men themselves. Still Trade Unions exist, and, what is more, they have been to a certain extent legalised by Parliament. The existence of such societies cannot, therefore, be ignored, yet I trust the Unions of the present day are not based upon the principles which actuated such societies a few years since, but that the only objects now in view by these combinations of working men are the protection of their own rights by lawful and legitimate means, and raising funds which shall be applicable in times of sickness and distress.

The settlement of questions affecting the rights of employers on the one hand and the claims of workmen on the other has always been a matter most difficult to solve. The most summary mode of procedure on the part of the workmen hitherto has been the resort to "strikes," but such suicidal policy has failed in almost every instance, and after the squandering of immense sums of money, utter prostration of trade, and poignant distress and poverty on the part of working men and their wives and families, work has been resumed upon former terms, a wide breach having been made between employer and employed which years have scarcely failed to heal. I need not refer to the "strikes" which have taken place in the iron, coal, and other staple trades of the country; they will readily present themselves to the minds of your readers, the more especially so as the evil results of some of them have not passed away from our midst at the present moment.

Strikes having failed to accomplish their aim, the next course was the establishment of Courts of Arbitration. I for one regarded with much promise and favour such means of conciliation, and rejoiced at the evident satisfaction with which they were received by the working men, and also the willingness of employers to recognise such courts of appeal upon questions at issue. In the establishment of Courts of Arbitration Mr. Mundella, M.P., deserves the warmest approval of all classes. He laboured earnestly and disinterestedly for the welfare of all, and his efforts in many instances happily proved successful. If we recognise the rights of the employer and capitalists on the one hand and of the employed on the other hand, questions of considerable moment will continually arise upon which difference of opinion will exist, and it appears both rational and feasible that such questions should be referred to some court or tribunal, the members of which shall be properly qualified, where such questions shall be calmly discussed, and whose decisions should be final and irrevocable.

But the theory just propounded, and which found public expression in the speech of Lord Stanley, at Liverpool, last week, raises another mode for the settlement of vexed questions between capital and labour—co-operation. Lord Stanley is unquestionably an able statesman, and his remarks are deserving of the greatest attention and respect; but at the same time I take the liberty to question whether the policy which he advocates with so much fervour will prove the panacea for the evils which at present exist, and the difficulties which have to be solved between capital and labour. The theory propounded by Lord Stanley is to give the working man a certain proportion of the profits which accrue to the capitalist and employer upon the capital he has invested; the argument being that the working man brings his capital into the concern in the shape of labour. Glanced at superficially, the idea seems but fair and reasonable—that the working man should share the profit upon the work which he has accomplished. Granted then, for the sake of argument (but which I very much doubt), that the capitalist and employer would take into co-partnership his workmen, or give them a proportion of his profits, the question, then, naturally arises whether the working men would in times of depression and stagnation of trade submit to proportionate reduction of wages, and thus bear a portion of the manufacturers' loss. The argument must be fairly reasoned out. For my own part, I think that trade and commerce would be hampered and restricted by the co-partnership of working men, who cannot possibly have any correct idea of the requirements of business; but, altogether irrespective of that aspect of the question, I venture to think that the working men themselves would denounce the system in times of stagnation, and would willingly resort to the old system of fixed wages. To refer to the iron and coal trades, I should like to know what remuneration the collier would expect during the many months, sometimes years, which are devoted to the winning of coal, and during the whole of which time the capitalist expends such a vast amount without a shilling return? Again, what remuneration would our puddlers, our furnacemen, our rollers, &c., in the iron works have received during the past four or five years (provided the co-operation system had been in existence), when it is well known that our iron works have, in the majority of instances, been carried on at a positive loss? Wages must have been very much lower than they have been. I am very much afraid that if put to such practical tests as these the principle of co-operation will not be found to answer. The working men can scarcely expect to share the profits of prosperous times unless they are quite prepared to share the loss also of times of stagnation and depression. The very term "co-operation" means reciprocity. Wages would fluctuate with the state of business far more than at present; and I believe, with all due deference to the noble lord, that more discord would be the result than at present exists. The working men would gladly share prosperous times in the shape of increased wages, but would be very reluctant to abide the loss in times of prostration and quiet. The principle advocated by Lord Stanley may be found to answer in certain trades, where but small sums are required, and where quick returns are assured; but it would utterly fail where large capital is invested and sunk, without any returns for many months, perhaps years. I prefer, therefore, still having faith in the honour and integrity of our merchant and employer, depending upon his sense of justice to give such "a fair day's wage for a fair day's work" as the circumstances of trade will justify; and in those questions which may arise where difference of opinion exists to submit them to the decision of properly qualified Courts of Arbitration.

H. J.

*Oct.* 13.

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### COLLIERY EXPLOSIONS.

Sir,—I am obliged to your correspondent, "C.V.," for the attempt to give the information I asked, but I must yet acknowledge, even after his explanation, that I am at a loss to see how the old workings of a 4-ft. seam of coal can be filled up so as to leave no space for the lodgement of gas, even if the system of working adopted be the long wall; but pillar and stall are mentioned, I see. "C. V." says the roads are about 15 yards apart, which, I suppose to be formed of pack walls, and by his explanation there will be a space of 9 or 10 yards by 60 yards long between each road, filled up with small coal, the refuse being required for the packs; or, in other words, suppose an acre of coal to be got out, two-thirds of the space thus excavated will be filled up again with small coal. Now, I think this is really worse and worse.

I can imagine a travelling road being made every 15 yards, and the roof being allowed to come down betwixt the packs that form the roads for building material till the working faces have advanced 60 yards; then a cross-heading or cross-pack gate being formed, and those roads just abandoned being filled up by refuse. But even this does not prevent the formation of space for lodgment of gas; the superincumbent strata would gradually come down, perhaps half the thickness of the seam of coal, and form space above in proportion to the nature of the roof. Gas thus accumulated would be liable to come out any time when a second fall took place, and all the refuse you might put in would not prevent it, no more than it would prevent the roof falling.

A. V.

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### WINDING MACHINERY FOR MINES.

Sir,—Two gentlemen connected with this district—Mr. W. Thomas and Mr. W. Davis, of Gadlys Iron Works, Aberdare—have suggested an improvement in winding machinery, which appears to me rather retrogressive than otherwise. I, therefore, take the opportunity of expressing my views through the *Mining Journal*, in the hope that it may be the means of preventing unnecessary loss of life, for I am compelled to give it as my decided opinion that the use of their invention would be positively dangerous. They propose to dispense with the present system of rolling the rope on drums, and to employ instead one length of rope, with a cage at each end, passed twice round the winding-pulley, as sailors pass a rope round a capstan

They propose to apply the power to the axle of the pulley round which the rope passes, and estimate that by this means the quantity of power necessary will be materially diminished. Whether this would or would not be the case I will not now discuss, but admitting all the inventors say to be true, I believe the new system of drawing would be objectionable.

The breakage of a rope is bad in any case, but it appears to me that, according to the invention of Messrs. Thomas and Davis, the breakage of a rope would involve the imprisonment of the miners for many hours, as both cages would be rendered helpless. It is scarcely to be supposed that if the new system were adopted the same amount of power as at present would be employed, so that upon the rope breaking neither cage could be brought to surface until the rope was repaired; at present one rope may be employed whilst the second is disabled—one rope only falls to the bottom of the pit in case of accident, which would be most inconvenient. That Messrs. Thomas and Davis's system would be very economic I do not doubt, but the question is whether the economy would not be more than compensated by the increased danger. I am inclined to think that it would, but if the inventors would explain their course of action in case of accident perhaps unfavourable opinions concerning the invention would be changed.—*Oct.* 10. H. J. F.

## THE SOUTH STAFFORDSHIRE AND SHROPSHIRE COAL FIELDS—No. XIX.

Sir,—Notwithstanding the importance of our coal fields, and our familiarity with the valuable minerals they contain, it cannot be said that we have gained more than a mere shallow and superficial knowledge of them. As we become more intimately acquainted with their features we shall discover points of interest which will enable us to recognise them under some of the many disguises they assume at a distance, and to prove a relationship between members of the same family, widely separated from each other. In a former letter I said there could be no difficulty in establishing the identity of that important ironstone seam, the round coin-like shaped nodules of which have obtained for it the name of Pennystone, in three or four counties in the Midlands, and I am of opinion that it may be traced even to a greater distance. It is more persistent than any other stratum, either of coal or ironstone, which is precisely what we might expect to find, seeing that it required so large a body of water for its formation, and such a long period of time for its deposition in the fine sedimentary form in which we find it, as well as for the growth and decay of successive generations of creatures whose interesting forms lie entombed in it by myriads. Local geologists, it appears to me, could not be better employed than in accurately examining corresponding seams, and in comparing notes; field clubs and similar societies would also be doing good service to science if they were to undertake the supervision of such a work, and to depute men best qualified to undertake the task.

Widely as the South Staffordshire and Shropshire coal fields are separated from those of South Wales, there seems reason for believing that the Rosser veins of the latter are the representatives of the Pennystones and Penny Measures of the former: the fauna of both are marine; both show the trail, burrows, and casts of marine worms, and of those locomotive, excavating, bivalves formerly called Unios, now known as the Anthrocosia, originally understood to be fresh water species, but now believed to have lived in salt water—like others with whom they are found associated. The extent to which specimens found in one are common to the other may be seen from the following list of those occurring in the Rosser vein, of which I have at different times found corresponding specimens in the Pennystone—two species of Orthis:—

1.—Discina nitida.
2.—Lingula mytiloides.
3.—Aviculopecten gentilis.
4.—Schizodus Sulcatus.
5.—Ctenodonta æqualis.
6.—Edmondia uniformis.
7.—Myacites sulcata.
8.—Litorina? obscura.
9.—Conularia quadrisulcata.
10.—Bellerophon hiulcus.
11.—Megalichthys, Hibberti and other species.

The ell balls, too, of South Wales, from the predominating impressions of plants contained, seem to be identical with the ball stone of the Shropshire field, whilst the Darran Pins appear to be the equivalents of the White Flats.

I will not attempt to correlate the Pennystones of Shropshire, South Staffordshire, and North Staffordshire, or the stinking coal of the latter, which Mr. Smyth considers to represent the Rosser vein of South Wales, and the Pennystones of Shropshire and South Staffordshire. It may be difficult, as he says, to draw a parallel between the individual strata of the Potteries coal field and others we have mentioned, but, as he further remarks, there is undoubtedly every probability that the South Staffordshire and Shropshire, and those of North Wales, are all more or less connected with the North Staffordshire coal fields beneath the great mass of superincumbent red rocks which form the surface of the intermediate land. Many of the coals may be correlated in the same way, by taking one of these persistent and important ironstones as the line from which to plot. Mr. Marcus Scott, who is a diligent student of science, and a faithful interpreter of facts which come in his way, taking the Pennystone as his guide, has made out a list of coals which, in his opinion, correspond, and which he gave me the other evening during a conversation on the subject, with liberty to publish. This list, of course, is open to correction, and no one we are persuaded more than he would be pleased to find it amended. He commences with the stinking coal, of the identity of which there can be no doubt, as it immediately underlies the Pennystone in the Shropshire and South Staffordshire fields. Thus—

| Shropshire. | South Staffordshire. |
|---|---|
| Pennystone | Pennystone. |
| Sulphur | Sulphur coal. |
| Clunch coal, Two-foot coal, & Best coal | New Mine and Fire-clay coal. |
| Clod and Randle coal, Little Flint coal | Bottom coal, Singing coal of Tipton Green Pit. |
| Flint coal, Yard coal | Rubble coal, Heathen coal. |
| Double Half-yard and Top coal | Thick coal. |
| Gur coal, Stone coal, Blackstone coal, and Fungus coal | Penny coal, Brooch, and Two-foot coal. |

Again, as shown by the late and much lamented Prof. Beete Jukes, the Brooch coal at Essington and Wirley splits up into a number of coals; also the Thick coal, which becomes the Essington fifth and sixth coals, the Wyrley Old Robins coal, Yard coal, Charles coal, Benches coal, Brooch coal, and three or four others. They become still more divided in the direction of Brerton and Cannock, although at the same time maintaining pretty much the same total thickness when added together. They then dip under red and blue marls and rocks of the Red Sandstone, to re-appear in the Pottery and Silverdale coal fields of North Staffordshire, increased in number and total thickness, after which they again dip beneath the Permians and New Red Sandstones to the west.

The importance of correlating these coal and ironstone seams, in my opinion, lies in the fact that it points to certain uniform conditions prevailing over very wide areas, and almost uniform levels of surface over those areas. One of those conditions was the presence of sea water, which, excepting in the case of the formation of the Pennystone, and some other ironstones, might not have been deep, although so extensive as to embrace South Wales, Shropshire, the two divisions of Staffordshire, and, probably, two or three more counties. The presence of marine forms in the coals, coal shales, &c., indicates also pretty clearly that this sea water must have had free access to the coal-producing plants of the period. Scorpions and beetles being found in the ironstones of Shropshire, and remains of air-breathing reptiles elsewhere in the coal deposits, are sufficient to show the presence of land and sub-arial vegetation, but it by no means follows that the vast coal growths of the period were altogether on dry land. In Shropshire we find fossil trees with stigmaria roots embedded in sand, but these, and a considerable portion of their trunks might have been beneath the waters; indeed, the little seed cases in the coal, more particularly in the more impure parts of it, are so sharp and perfect that they could not have been drifted far. I find them in abundance in the lowest coal, the Lancashire Ladies, in the Little Flint coal, the Clod coal, Randle coal, and others, up to the stinking coal; some partaking of the colour of the coal itself, others preserving a yellow-brown colour, with amber-looking substances inside. These trees appear to have been capable of establishing themselves in the rising mud, and to have maintained an existence for some time amidst deposits tranquilly accumulating in the shallow waters around. On this subject Prof. Rogers says, "Only one particular process of accumulation promises to explain the occurrence of these. I cannot conceive any state of the surface but that in which the margin of the sea was occupied by vast marine savannahs of some pea-creating plant, growing, half immersed, on a perfectly horizontal plain, and this fringed and interspersed with forests of trees shedding their leaves upon the marsh." At times the subsidence of the land appears to have been too rapid for the accumulation to keep up sufficiently to maintain vegetation; shell-fish then swarmed in the waters, anthrocosia being so thick in the bass over some of the coals that one wonders how they could have lived.

It might be convenient at this point, in continuance of the recapitulation in letter No. XVII., to say that it was at this stage, or soon after the coal measures were complete, that a change took place which led to the recently formed coal measures being denuded. I have all along considered the destroying force to have been brought to bear upon them from the south, or south-west. I find, too, Sir H. De la Beche, in his *resume* in the Memoirs of the Geological Survey, Vol. I., contending for some such force also acting from this direction on the South Wales coal basin, which, like our own, suffered from denudation. That field is shown to be traversed by longitudinal valleys running from south to north, being the same direction as that of the Shropshire and South Staffordshire fields. It is only reasonable to suppose that such force would be strongest and most destructive nearest to its source, and that it would decrease in proportion to the extent of its radius on the Shropshire and South Staffordshire side. Thus, we find it acting with great intensity on the South Wales coal field, which was only saved from utter destruction by its singular basin-like depression, and by the strong rocky barriers of carboniferous limestone and millstone grit which protected it. Its effects, however, are evident in the denuded edges of the coal measures forming part of several counties of South Wales, in the Forest of Dean coal field, in the coal measures of the Clee Hills, which were cut through and rounded into islands by its action. It left just the lower members only, first one on the Old Red Sandstone, south of Shirlot, two or three only on Shirlot itself, then eat its way into the upper members, and continued its ravages to Oswestry, Wrexham, and Mold. It never completely cut its way through the coal measures north, but left a crescent-shaped coast line in the direction of Cannock Chase and North Staffordshire.

*Madeley, Oct.* 11. John Randall, F.G.S.

[In my last, three billions six hundred millions should have been three thousand six hundred millions.]

## REVIEW OF COAL MINING.

Sir,—Proposing to view this question in reference to the occurrence of accidents, and how far we have advanced in the means of preventing them. Explosions in the early times of coal mining generally originated from the limited supply of air for ventilation, and not causing that air to sweep through the open places, which were capable of being ventilated. Explosions occur in much the same way in our own times, but under somewhat different circumstances. In most collieries the circulation of air has been greatly increased, compared to former times. In our important mines, by the establishing of large furnaces or powerful machines, and other aids to ventilation, large quantities of air are passed into them. It may be asked why this great increase has not tended in a greater degree to prevent explosions? It is known that 14 times the volume of air to that of gas is required to render the mixture harmless; it may be asserted that in most gaseous mines four times this proportion of air or more is maintained, so as to have some margin for extraordinary conditions occurring. Our answer is, the danger to be encountered arises from extraordinary circumstances, sometimes in the form of a sudden outburst of gas, but more frequently from gas accumulated in places shut off from the system of ventilation. The latter state of matters may be brought about by accidents, as falls, or it may be the result of negligence. It is clearly, then, our duty to institute a system of ventilation which will reduce these contingencies to a minimum—that is, a system specially adapted for the conditions or peculiarities of each district, its primary object being to avoid accumulation of gas in every part of the mine. I believe this to be the only mode of prevention. If the coal be got by long wall, let the parts excavated be filled up with refuse material, if possible. If the bord and pillar system be in practice, let the gas be drawn off from the goaves regularly, by mechanical means, at the highest level, where we may naturally expect its appearance.

The Effect of Legislation on Coal Mining.—Parliament passed an Act requiring two outlets for every mine. The great Hartley accident led to this measure, and of the wisdom and necessity for it further proof has been recently afforded in the accident at Avondale, in America. The employment of women underground has been prohibited, and of boys under 12 years of age, excepting boys between 10 and 12 who have certificates of education or school attendance. The Act, commencing Dec. 31, 1860, for the regulation and inspection of mines, repealed a former Act, and contains provisions for the employment of men in charge of engines, the powers and duties of Mine Inspectors, the general rules to be observed in coal and ironstone mines, the special rules to be established at each for the guidance of those acting in the management, and those employed as workmen in the mines; it requires notice to be given to Inspectors of the abandonment and opening of any mine; wages to be paid to persons employed in money. Offences against the Act are punishable by penalties or imprisonment. These have, no doubt, had a very salutary effect in preventing accidents, and further legislation it is believed will take place next session on the questions of education of miners and their children, the hours of labour, and protection from accidents.

Further Means of Prevention.—It would, no doubt, serve a good purpose if a certain scale of ventilation was enforced in mines, in accordance with the area of workings, production of gas, and output of coal, and the proper distribution of the air into every working and abandoned place, and the adoption of the most approved safety-lamp. It seems almost incredible that in most mines lamps are used which will pass flame in a current of 8 feet per second; in most fiery mines we know the velocity exceeds this. Moreover, an accident may give a sudden impulse to a mixture of explosive gas, and the ordinary lamps under those circumstances would be anything but safe ones. Our object however is, we repeat, to do away with the primary cause of accidents—accumulated gas—the lamp would only be of secondary importance. Lamps on the Clanny or Mueseler principle are to be preferred, as they give sufficient light; there is, then, less reason or motive for taking off the top. Lamps should be provided by the owners, and smoking prohibited underground. We may propose the division of workings into panels, so as to limit the effect of explosion, and confine it to one panel, if possible, but this is dependent on the amount of gas and force of explosion; we may endeavour to restrain its ill effects in one way, and it will naturally fly in another way—that is, direct to the downcast pit, where it would occasion the most serious mischief. We do not set up any defence for this system, our efforts would be directed in the most efficacious manner to sweeping off the gases regularly with the currents of wind.

Owners of Mines may greatly Assist the Object.—It has been said that pits should be sunk more frequently, in order to secure a larger measure of ventilation and increase security. This is a question which must be ruled by money considerations; the sinking of more pits may deprive the colliery of its profits, and prevent a return of the owner's expenditure. He would prefer adopting more powerful machinery and appliances to ventilate with existing pits than incur expense which might be ruinous. Owners of mines of the present day expend a great portion of the capital in machiney for raising large quantities of coal, but they give, we trust, equal consideration to the security of those employed daily in their mines by liberality in providing for good ventilation, efficient lamps and machinery, which as the means of preventing accidents will at the same time conduce to their benefit.

Co-operation of Agents and Workmen.—As men begin to take more thought of their lives, and look after their own safety, instead of trusting implicitly to others, so do we hope for a greater measure of safety in mines. The system of laying out and conducting the workings and ventilation must be a sound one in the first place, and if this is seconded by resolution on the part of agents to have good ventilation in every part, no gas accumulated, double air-ways and returns, we should then have some faith in the regulation of our mines, especially where the men interest themselves in these matters, and conform rigidly to the established rules. What seems to be wanted is the institution of a system of working adapted to the particular circumstances of each district, as to height of seam, dip, nature of roof, and debris for filling up, the first principle of which should be to prevent accumulations of gas to occur; this, if carried out, would be the surest defence against accidents from explosion. The problem is a difficult one to solve, on account of the varying conditions under which coal seams are found; a moderate dip—3 inches per yard and under—is one most favourable condition, as the loose material can then be taken from any part of the mine to fill up the stalls and gateroads when they are finished. There is need, and it would be desirable, to have more uniformity in the system of working coal. The system of long wall is undoubtedly the one possessing the most advantages in safety, as regards fire-damp, the proportion of large coal produced, and the simplicity of arrangement for carrying out the ventilation, these depending very much on the cavities being filled up close with the debris of the mine, and its economy depends greatly on the facility with which the loose material is obtained.

*Oct.* 12. M. B. Gardner.

## DRESSING MACHINERY—No. I.

Sir,—From time to time attention has been directed to various dressing appliances patented in this country, and the question has been raised as to their novelty and utility. As the proper and economical enrichment of ores is a matter of the greatest importance to the mining community at large, and as designing schemers seem likely to attempt to block the free use of machines long known both in Germany and by many persons in England, it may be advantageous to state that no patent is valid if its proprietor claims the use of things already known, or insists upon the novelty of combinations, which, at best, are often but clumsy modifications of useful and well-tried apparatus. The improved machines, which may be freely used by the miner without reference to "block patents," are—clearing trommels, rotating tables, sizing trommels, crushers, the Kroll Hardt jigging apparatus, coarse and fine sand jigging-machines, spitzkastens or sizing-boxes, sizing-troughs, the concave buddle, continuous round buddles, Rittinger's buddles, side-blow shaking-tables, and the revolving stamps-head.

Clearing Trommel.—This is a wooden or wrought-iron cylinder, designed as a substitute for the washing-kiln. Sometimes the cylinder is mounted on carrier-wheels, as shown in plates 9 and 10 of "Rittinger's Aufbereitungskunde," edition 1867. In other instances the shaft passes through the centre. Within this cylinder, angle or T-iron is fixed, for the purpose of disintegrating clay and soft substances, and at the discharge one or more cylinders of perforated plates are sometimes attached, for the purpose of dividing the stuff previous to its admission to the sizing trommels. One of such trommels, 4 ft. diameter and 14 ft. long, will wash about 60 tons of vein stuff in two hours.

Rotating Tables.—These tables are fixed in front of a wash-kiln or clearing trommel. A table, constructed of wood, and long in operation at Goginan, in Cardiganshire, is illustrated in a work published in the year 1862 by M. Moissenet. In Germany these tables are made of iron, mounted on a vertical shaft; the area around the centre is open for receiving "dradge" or prill ore, whilst the circumferential area is used for picking purposes, and for carrying the waste against a scraper, from whence it is diverted into tram-wagons.

Sizing Trommels.—These have been long employed at Devon Consols and at other English mines, and consist either of separate sizing drums, driven by one general shaft, or otherwise of a continuous trommel, divided into sections, each having perforated holes of different diameters. When the axis of a continuous trommel is placed truly horizontal the trommel takes a conical form, but when the trommel may be inclined then the barrel is parallel with the line of the axis. For illustration and particulars of this important part of dressing appliances, see "Ure's Dictionary," pp. 71, 72, and 90; also, model No. L., 11, in Museum of Practical Geology; and "Rittinger's Aufbereitungskunde," plates 9 to 14.

Crushers.—The improved arrangement of keeping the rolls in contact by means of discs of india-rubber and iron, instead of levers and weights, is shown and described in "Ure's Dictionary," p. 73. Fine or "chat" crushers are now frequently fed by means of a roller revolving over the crushing-rolls.

Kroll Hardt Jigging Apparatus.—This machine was introduced into the German mines some four or five years ago, and subsequently made in England, and sent to Australia. It is designed to separate at one jigging operation, and upon one and the same jigging bottom, the stuff into clean ore, "middles," and "castaways." For this purpose, it is provided with adjustable stops or slides, three outlets, and the same number of shoots. Kley's motion (which is, in every way, preferable to eccentrics) is frequently employed for driving this apparatus. The difficulty of adjusting the stops or slides to suit stuff of varying richness has placed this machine in the category of a rough concentrator.

Osterspey Jigging-Machine.—The Kroll Hardt apparatus is being generally superseded by the Osterspey machine. This is constructed with two sieves, one in advance of the other, the same as in Hunt's apparatus, only the latter is not provided with bridges and chambers for collecting the best and seconds ore. The completeness of the Osterspey apparatus in every detail ensures for it an extensive and permanent use, both in lead and copper mines. It dispatches a large quantity of stuff per diem with the use of a minimum quantity of water, and does its work in a highly satisfactory manner, one boy being able to attend to six machines.

Coarse Sand Jigging-Machines.—A model of these machines has long been exhibited in the Museum of Practical Geology, No. L., 28 and 29, and was contributed by the late Mr. Arundel. The hutch is a wrought-iron syphon or U tube, of rectangular section, fitted with inlet and discharge valve, sloping trough, &c. The pistons are driven by Kley's motion.

Fine Sand Jigging-Machines.—The Harzer apparatus is employed in Germany as a substitute for the round buddle. It is composed of three or more sieves, one in advance of the other. The pistons are driven either by the old eccentric method, or otherwise by a link motion—the latter being altogether preferable to the former. This machine may in every way be regarded as an extension of the arrangements of Hunt's machine. It has been made in England for exportation during the last three years.

Spitzkastens, or Classifiers.—These are extensively illustrated in Rittinger's great work, plates 15 to 18; also, to a limited extent, in "Ure's Dictionary," pp. 86 and 89; and in a small pamphlet by Ulrich, of Melbourne, Australia. Further, models of the apparatus, No. L., 12 and 13, are placed in the Museum of Practical Geology. These pyramidal troughs are largely used in the German dressing establishments.

Concave or Slime Buddle.—The ore in this buddle is concentrated on the periphery of the floor, instead of the centre. The distributors consist of small V launders, drawing the slime and water from a central trough, whilst the slime is diluted, and spread at the point of discharge by a rose jet of water. This apparatus is described in "Ure's Dictionary," p. 100, and has long been used in Cornwall.

Continuous Buddles.—Models of these buddles are to be seen in the Museum of Practical Geology, No. L., 18, 19, 20, and 21.

Rittinger's Continuous Shaking-Table.—A model of this apparatus, L. 38, is exhibited in the Museum of Practical Geology, and drawings and description are given in Rittinger's work, plates 25 and 26; also, in "Ure's Dictionary," p. 111.

Stamps with Rotating Heads.—The model, No. L., 8, in the Museum of Practical Geology, shows the form of rotary stamps-heads and driving-cams used in Australia. The German stamps are illustrated in "Ure's Dictionary," p. 75, whilst full description and illustrations of the Californian stamp will be found in "Phillip's Mining and Metallurgy of Gold," pp. 178 and 184.

Information relative to these and several other varieties of dressing machinery may be gathered from the "Descriptive Catalogue of the Geological, Mining, and Metallurgical Models in the Museum of Practical Geology," from "Rittinger's Lehrbuch der Aufbereitungskunde," "Moissenet's Memoirs on the Mechanical Preparation of Tin and Lead," "Ure's Dictionary of Arts, Manufactures, and Mines"—article, "Dressing," vol. 2; also, from "Die Aufbereitung," by G. M. F. Gaetzschmann, now in course of publication; whilst the extensive dressing establishments at Stolberg, Commern, Bensberg,

Ems, Iserlohn, and the Harz may be visited with great advantage to the mining student and engineer.

X.

## THE FUEL RESOURCES OF IRELAND.

SIR,—As Ireland is at present the subject of extraordinary discussion, anything connected with her industrial position, and the prospect of future prosperity, is sure to interest your readers.

The Land Question is now in the foreground, and will soon agitate the Senate, as it now agitates the country. Connected with the way in which land is held and let, many other questions must arise which have not as yet commanded attention. Among these the Mineral and Fuel Resources of Ireland, and how far their utalising may be affected by existing laws, are amongst the most prominent. With your permission, I will assist in bringing the subject to public notice in your columns, by affording some information upon the fuel wealth of that country.

The materials which constitute the supplying of fuel to the inhabitants of the British Isles, as to those of other countries, are derived from the vegetable kingdom, these are either wood of recent growth or else coal, or peat, or lignite, which are formations of the decomposed remains of the vegetable growths of ages long past, whose chemical changes and more compressed masses are so familiar to us. In Ireland, until a comparatively recent period, a very large portion of its surface was covered with very old and magnificent forests. The Irish oak was famed throughout Europe, large quantities of it were used for building the ships of Britain, and the historic roof of Westminster Hall is said to have been constructed of that material. One of the many names of Ireland found in the old vernacular annals was "Inis Fiodh" (the island of woods). The extent of the peat fields and of the bogs, and the quantities which are found in turf cuttings and other excavations establish the fact, and down to a late period of the last century blocks of timber supplied many of the Irish hearths and innumerable iron-smelting houses all over the country, which in the absence of that nutriment have ceased to employ the Irish people, to feed the English markets, and add to the national wealth. The mineral supplies of Ireland, though not yet carefully explored, are extensive, and the most useful are exhaustless, yet they contribute in only a very trifling way to the employment of labour or the investment of capital. Much of the ores in their crude state are transported across the Channel, to undergo those indispensable processes which the price of the fuel requisite for them at the mouths of the pits and adits renders too expensive. Many causes have co-operated to denude the land. The woods and bogs for centuries of endless wars between the native Irish and the English colonists afforded shelter and safety to the fugitives. The old fir, birch, and oak fell beneath the soldier's axe; many were eradicated to clear the way for spade and plough; and thousands, as Boate informs us, were cut down to prepare charcoal for the manufacture of iron, which as he testifies—coroborative of what has been just said—was then carried on (two centuries ago) in great activity throughout that country. During this devastation no one planted; indeed, there was no encouragement for planting, for the planter, unless lord of the soil, had neither right nor title in the growth of what he provided, and which owed its existence to his foresight and labour. The lamentable consequence is that at present Ireland cannot produce timber to meet the necessary requirements for household purposes, and it is scarcely ever used as fuel.

The coal formations of Ireland, Sir Robert Kane says, are seven in number—one in Leinster, two in Munster, three in Ulster, and one in Connaught. In olden time the Irish analists say Ireland was divided into north and south by a line drawn westward through the centre of the island from Dublin to Galway, to adjust by a defined boundary the contending claims of two rival princes—Mogha and Conn. It is a curious fact that the coal found north of this line essentially differs from that found on the south. The northern coal is bituminous or flaming, that on the south is anthracite, and burns without flame. This peculiarity is, no doubt, caused by the difference in the geological formation of the districts. The coal fields lie in the counties Carlow, Kilkenny, Queen's, Tipperary, Limerick, Cork, Kerry, Antrim, Tyrone, Sligo, and Roscommon. Seventy-three collieries have been worked. Of these thirty-four were at work in 1867. Of the seventy-three collieries six are in Ulster, seven in Connaught, thirty-one in Leinster, and twenty-nine in Munster. The returns of sale for 1867 show that anthracite yielded 75,000*l.*, and bituminous coal 50,000*l.*

Previous to the introduction of an improved system adopted on the recommendation of the late Mr. Griffith and Mr. Aher, the extraction of coal was so rudely performed, that when the shafts had reached a certain depth many of the pits were abandoned. As a consequence coal was costly: 20s. a ton was the usual price for the screened coal, the small or culm sold at prices ranging from 5s. to 8s. a ton. Steam is now employed for draining many of the abandoned pits. The coal raised in the Leinster district was estimated in 1856 at 120,000 tons per annum, and sold at about 11s. 6d. per ton. The Tipperary fields then yielded 50,000 tons per annum, and the price was 12s. per ton. The hills which surround Lough Allen, an expanse of the Shannon, submerging 9000 acres of land, constitute the Connaught field. This district is described in language soaring to the poetic by Sir Robert Kane:—

"The dark-brown hills, heather clad, rose abruptly from the water, excepting towards the south, where they were separated from the lake by level spaces of marshy bog. The patches of cultivation, small and rare, far from relieving the aspect of the scene, served but to render its dreariness more oppressive. The lake, smooth as a river, reflected the sky of midsummer. No sound disturbed it; the noise and bustle of active industry were far away. The melancholy solitude of my walk was only broken by the approach of some wretched men, who had heard of the phenomenon of a stranger's presence in their wilds, and pressed around, asking whether I was about to do anything for the country, to give employment. As I walked on, there lay around my path masses of iron ore, equally rich with the best employed in England. There were concealed all the materials for successful industry. A population starving, and eager to be employed at any price. A district capable of setting them at work, if its resources were directed by honesty and common sense."

The coal district in this attractive locality is 16 miles square, the total area 114,000 Irish acres. It is divided by the River Arigna into southern and western portions. The great mountain ridge named Brahlione, and at its base lies the Arigna Iron Works: near there, in the place where the fire-clay was wrought, the coal is 3 ft. thick, and its outgoing, Mr. Griffith says, may be traced along the face of the hills through the greater part of both divisions, and is, fortunately, of great extent. The quality of the coal as fuel for domestic purposes is excellent, and if used for smelting iron is among the best in the empire.

Lignite is an intermediate between wood and coal. Its economic value is about two-thirds that of coal, the heat more diffusive, but less intense. It extends over a considerable area, in dense strata.

Turf is of modern formation. Geologists allege that the primary cause of bogs in Ireland, and of their great extent, is the excessive moisture of the climate, coupled with the tendency to the luxuriant growth of mosses. The total area of turf or peat bog in the island is calculated to be 2,830,000 acres, constituting nearly one-seventh of the entire of the total: 1,756,000 acres are flat bog, spread over the limestone plains, the remaining 1,250,000 acres are mountain bog. For the sustenance of flaming fires turf has been tried and found applicable, and peculiarly useful for boilers, as it is found it does not burn the metal, as coal and coke do, in consequence of the intense heat they yield. Its economic value is estimated at 44 per cent. of that of ordinary coal, and if treated on an enlarged scale could be properly compressed and sold at 3s. 6d. per ton, a result which would render fuel sufficiently effective, cheap, and abundant to meet all local industrial demand, and bring again into active operation all over the country the iron-smelting houses, which until the fall of its woods was a characteristic feature of Irish manufacture: the other mineral resources of Ireland would then be equally beneficially affected. It is only by operating on an extensive scale, with ample capital, and adequate machinery, that any good can be done. A fine coherent coke would be the result, and with a density greater than wood charcoal. It may be carbonised, like wood, at an expense of from 25 to 30 per cent. I shall close these remarks with the following significant extract from the work of an eminent scientific authority. On a careful consideration of the extent of the coal fields and bogs in Ireland, and their estimated produce, he says:—

"Although destitute of the grand development of mineral fuel which has rendered England the centre of industrial arts, we (the Irish) yet possess several coal districts of considerable extent, and yielding large supplies of fuel; and, moreover, there is in our bogs amassed a quantity of turf, which, if the peculia character of that fuel be suitably attended to, may become of eminent importance to the country."

*Dublin, Oct. 5.* ERINACH.

[For remainder of Original Correspondence, see this day's Journal.]

## THE METALLURGY OF IRON AND STEEL.

The extraordinary progress which has been made in the manufacture of iron and steel during the last 20 years has rendered even the most valuable of the standard works upon the metallurgy of those metals altogether obsolete, so that a new and complete treatise upon the subject, by so competent an authority as Dr. H. S. OSBORN, Professor of Mining and Metallurgy in Lafayette College, Pennsylvania, will be sure to meet a favourable reception. It was intended in the first instance to merely re-edit Mr. Overman's Treatise upon Iron, but it was found that so many important inventions and discoveries had been made since the last edition was published that this would be impracticable, and Prof. Osborn, therefore, wisely undertook to write an entirely original work,* embodying, however, all such material from Mr. Overman's book as he considered was still useful. The result is that he has produced a volume which will be valuable not only in America, but wherever the manufacture of iron and steel is carried on. After having taken care to make his readers thoroughly acquainted with the various kinds of raw materials they are likely to meet with in America, Prof. Osborn explains the several modes of treating, carefully pointing out the advantages, disadvantages, and the opinions entertained concerning each. A sound knowledge of what has been done in metallurgical literature by others is displayed throughout the work, and whilst the labours of all have been well utilised, there is less appearance of plagiarism than is observable in the books of many authors who are less honourable in acknowledging the source of their information.

Of the large number of intelligent and successful ironmasters few have the advantages or the time to become chemists, but many have attempted impossible or useless experiments, and before their final success suffered great losses of material, time, and money through lack of the knowledge of plain chemical truths and principles, combined with deficiency in mechanical and practical ability. These facts Prof. Osborn thoroughly recognises; and, therefore, in the most practical manner alludes only to those leading chemical principles with which it is essential that the ironmaster should become acquainted. With regard to the formulae, he uses the old notation, which, it must be admitted, is that best suited for the requirements of the practical man, being more simple and, although, perhaps, strictly speaking, less accurate, ample for general purposes. His mode of explaining the symbols is admirable, and he observes that the oxides of sodium and of potassium, or Na O and K O, are soda and potash, or, as the letter "a" terminal indicates an alkali (take silica for example), potassa. From Prof. Osborn's description, however, the mode of combination can be very readily understood, and will be found quite sufficient to enable the student thoroughly to comprehend the succeeding portion of the work.

To enable the ironmaster to acquire a knowledge of the chemical characteristics of each of the commercial ores used in the manufacture of iron, Prof. Osborn enumerates all the commercial ores of iron, and at the same time treats of those elements which influence favourably or unfavourably the production of iron in the furnace. The localities in which the several kinds of ore are met with and worked are carefully pointed out. One of the most interesting references under the head of magnetic ores is the allusion to the celebrated Franklinite. He observes that it was regarded as essentially a magnetic oxide, with the protoxide partially re-placed by oxide of zinc. Some analyses seem to contradict this, but till there be further light on the subject it may be thus classed. Rammelsberg's analysis shows the ore to consist of a combination of peroxide of iron, 64⅛; binoxide of manganese, 13⅛; and oxide of zinc, 25⅛. It is treated as an ore of zinc, and when the iron is smelted it appears as a characteristic spiegeleisen. The ore has been recommended as a remedy against both cold and red shortness. It is supposed that both sulphur and phosphorus were extracted by the zinc and manganese, or by the zinc alone, and thus were removed the chief causes of red and cold shortness. Under the hematites, red ores, specular ore, &c., there is a reference to the beautiful deposit around Antwerp, Jefferson County, New York, in the cavities of which ore are found hairy radiations of sulphide of nickel. Then there are the brown hematites, concerning which Prof. Osborn remarks that in the United States the largest deposits are in the lower Silurian. Some ores of this kind are mined from the outcrop of the coal measures in Western and Middle Pennsylvania, and in Ohio. Brown hematite ores run from the Delaware opposite Easton, south-westerly over 100 miles, even into Maryland, beyond and south of York, Pa. Some of the beds south-east of York, judging from specimens examined, contain a large percentage of manganese. One specimen, sald by a gentleman who gathered it to be a sample taken from some 17 tons mined for brown hematite, contained more than 50 per cent. peroxide of manganese, and it could not be melted in any ordinary furnace. The spathose, fossil, argillaceous, and bog ores, &c., are likewise referred to in detail, and the chapter is concluded with a good review and practical remarks, and a good description of the modes of getting the ore from the mine.

With regard to the special properties of iron and its compounds, Prof. Osborn gives all the information that the most fastidious can desire, and his chapter on fuel is really excellent, his remarks on peat being especially worthy of attentive consideration. This fuel, on account of its chemical composition, is not without interest to ironworkers, because the question has been of late years considerably agitated as to the use of peat in iron operations. It has been found that peat is a most excellent fuel for the blacksmith's forge, as in case-hardening, tempering, and hardening steel, forging horseshoes, and particularly in welding gun-barrels. For this purpose, it is pressed and charred. Peat is generally found in bogs, in horizontal layers, from 10 to 30 ft. in thickness, sometimes in the form of a blackish-brown mud; sometimes it is a dark peaty mass, and often a combination of roots and stalks of plants; frequently the peat layers interchange with layers of sand or clay. Sea-water is better adapted to the formation of peat than rain or spring water. Peat is simply dug with spades, and then dried. If too moist to be dug the half-fluid mass is piled upon a dry spot, and there left until the water drains, and the mass appears dry enough to be made into square lumps, in the form of bricks or rolls. In many instances, however, the freshly dug peat is triturated under revolving edge-wheels, faced with iron plates, perforated all over their surface; through the apertures in these plates the peat is pressed till it becomes a kind of pap. This pap is put into a hydralic press, and squeezed until it loses the greater part of its moisture. It is then dried and charred in suitable ovens. The charcoal made in this way deserves the notice of the artizan. The amount of ashes in peat varies greatly, and, economically considered, are of considerable importance. Some specimens contain only 1 per cent., whilst others contain 30 per cent., which in direct proportion diminishes the value of the peat. But it is not so much the quantity as the quality of these ashes which interests us. Their value as a fuel to the blacksmith is indicated by their chemical composition. It is a remarkable fact that in peat ashes we never find any carbonated minerals, while they contain phosphates, sulphates, and chlorides. An analysis of peat ashes gave, in 100 parts—lime, 15·25; alumina, 20·5; oxide of iron, 5·5; silex, 41·0; phosphate of lime, 15·0; chloride of sodium, 15·5; and sulphate of lime, 21·0. In other kinds of peat 34 per cent. of phosphate of lime, and 6 per cent. of chlorides were found. The phosphates and chlorides have an excellent influence on the hardening and welding of iron and steel, and if we use peat for these purposes we should analytically investigate the ashes which it produces.

Though the elements of peat ashes are beneficial to the working of bar iron and steel, it does not follow that they are equally beneficial in reducing iron ore; for in the blast furnace phosphates of any kind are injurious, and produce a cold-short iron. Therefore, we should be very cautious when we recommend peat for the blast furnace. We should recommend only such kinds of peat as contain neither too many phosphates nor too great an amount of ashes; otherwise we run risk of producing bad work in the furnace. Dug peat that is applicable for the smelting of iron should never contain more than 5 per cent. of ashes. Peat contains less oxygen but more combustible matter than wood; it is a very imperfect fuel, because it generally contains too much foreign matter, and it is too expensive where wages are high. A great deal of it is used in different parts of Europe, where cheap labour and scarcity of wood and stone coal render it more available, but where wood or coal can be had at reasonable prices there is not much prospect of peat coming into use for the manufacture of iron. Still it is unquestionably useful in working steel and bar iron. In such cases, however, it should be subjected to a chemical analysis. Peat should never be used in its raw form, but only when charred. Where its composition is shown to be favourable by chemical analysis, we need not be harassed in relation to its price, for its utility is so obvious that a liberal expenditure may be safely hazarded. The expense of peat in comparison with that of wood or wood charcoal may be estimated by weight. The specific gravity of a cord of dry wood is from 2000 to 3000 lbs., and if we consider that air-dried wood contains from 30 to 40 per cent. of water, the real amount of combustible matter in a cord is reduced to from 1300 to 2000 lbs. Air-dried peat always contains more or less water, and this is to be deducted before we can know its real value. The amount of water varies exceedingly, ranging from 10 to 40 per cent. It can be easily estimated by weighing the peat when fresh, then exposing it to a heat of 212°, and again weighing it—the difference is water. According to this a ton of air-dried peat ought to be worth as much as a cord of wood, provided the quantity of ashes in the peat is not too great—say, 10 per cent. This quantity can be found by weighing a piece of peat, and burning it slowly on a plate of sheet iron until all the carbon is expelled. This operation requires a red heat. The remainder is ashes. If peat is dug for the purpose of charring it is advisable to employ a good strong peat press. Peat thus pressed chars excellently, and yields a charcoal as hard again as the best sugar maple or hiccory coal.

These observations with reference to peat may be taken as a fair specimen of the style in which the whole book is written, and it must be acknowledged that although there is a complete absence of any attempt at literary display, the information is given in precisely the style suited to the class for which the book is intended. The second part of the work is devoted to the consideration of the practical metallurgy of iron, and includes chapters on the roasting of iron ore, direct reduction processes, indirect extraction as cast-iron, building, blowing in, and practical remarks upon the management of the blast-furnace; the theory of the blast-furnace, the practice of charges, mixing of ores, cinders, hot-blast ovens, and waste heat are also treated of, as well as the details of the furnace—such as blast machines, blowers, valves, &c. In the third and fourth parts, to which we must take another opportunity of alluding, the manufacture respectively of malleable iron and of steel, are described, the various processes and the relative merits and defects of each being pointed out with the utmost care and judgment. To all classes of ironworkers the book will prove invaluable, for it is so arranged throughout that whatever may be the raw materials at their command they will be able at once to ascertain the best mode of dealing with them, in order to turn them to the utmost commercial advantage.

* "Metallurgy of Iron and Steel, Theoretical and Practical, in all its Branches." By H. S. OSBORN, LL.D., Professor of Mining and Metallurgy in Lafayette College, Easton, Pa. Philadelphia: Baird. London: Trübner and Co., Paternoster-row.

## LITERARY NOTICE.

*Statistics of Invention, illustrating the Policy of a Patent Law: Part II. of a letter addressed to the Right Hon. Lord Stanley, M.P.* By H. DIRCKS, C.E., LL.D., &c., 8vo. London: Spon, Charing-cross.

This pamphlet comprises a paper read before the Exeter meeting of the British Association last August, together with a full report of all the speeches it elicited in the discussion which followed. The paper itself we published *in extenso* in the *Mining Journal* of Aug. 28. Its main object is to show how patent law has kept alive and stimulated invention; and the folly of arguing against patent law as not being required for the promotion of further invention in arts and manufactures. In conclusion, Mr. Dircks pithily observes—"*Manufacturers* find that patent law fosters the decided inconvenience of introducing an amazing amount of competition, and competition, too, of a kind that even the oldest establishments cannot withstand, or the largest capital extinguish. Again, between *Patentees* patent laws are far from being all that they could desire, for, while appearing to protect the original inventor in the matter of his invention, they afford to every petty improver on his invention an amount of protection equal in value, so that the giant and the infant are virtually placed on an equality with each other. But, as regards the *Public*, the million, they know very little about patents; they never purchase them, and scarcely ever see them, and are utterly unaware whether patents ruin, interfere with, or enrich trade; their only experience is that the manufactures they purchase are perl·dically purchased cheaper; but they never conclude, however, on that account, that the prosperity of the country arises from losses of manufacturers on such patented articles of general consumption."

Alluding to Mr. Macfie's Olla Podrida, referring to the "Abolition of Patents," he remarks in his preface—"When the warm sympathies of thirty-two millions of people are sought on behalf of suffering humanity, the public may well exclaim—How strange it is that we have never heard of this terrible calamity before, and that in an age remarkable for sensational histories, we hear almost for the first time the faint wailing of thousands of manufacturers, and thousands of tradesmen, 'fettered' by an atrocious class of the community on whom the 'State' has unconstitutionally conferred powers in the name of 'Letters Patent;' but which we now learn are in reality something more stringent and oppressive than 'Letters of Marque!'" He next shows from Mr. Macfie's own witnesses, particularly from the evidence of Mr. J. Stirling, President of the Glasgow Chamber of Commerce, how averse the manufacturing and trading interests are to the rapid progress of invention, with its consequent train of innovation, reformation, and competition. Mr. Stirling candidly asserts that "The result, when things are left to themselves, is a happy combination of ingenuity and caution, and, as a consequence, a continuous but prudent course of improvement." What, we should like to know, is the limit to "leaving things to themselves;" and what is the proper interpretation to be put on a manufacturer's ideas of a "cautious but prudent course of improvement?" Mr. Stirling has a great horror of our making too rapid strides, such as they make in the United States, where, he assures us (as if with tears in his eyes), "the factitious value attached to inventions has tended to produce an almost total sacrifice of solid workmanship to a flimsy ingenuity." In what respect this heavy chargo actually applies to the workmanship of American artizans we are totally at a loss to understand, and only hope that some early occasion will afford Mr. Stirling an opportunitg of substantiating or of withdrawing such a sweeping and merciless charge. For our own parts we utterly disbelieve his statement, and consider it totally unworthy of the source from which it emanates. But of all narrow-minded views on the subject of patent law, none appear to us more open to suspicion than those certified by Boards of Commerce, composed as they are of merchants, manufacturers, and traders. Their opposition to patent law is metal opposed to mental qualifications. It is from beginning to end a money standard, and it is not in the most remote degree one that takes in that great enlarged view of the subject that considers the laws as made for the people. The aristocracy of wealth rules by money, measures by money, and understands little beyond personal aggrandisement; if laws are removed it principally is benefitted, or certainly long before the masses reap some trifling benefit; it gains by war, it gains by famine, and would now, if possible, gain by the abolition of patent law, and have free trade in other men's ingenuity. The writer on Patents, in the July number of the "Westminster Review," happily remarks, in reference to copyright as compared to patent right, that if the abolitionists could only gain their point, it might occur that, the inventor of a steam-engine would be without protection, while the author describing it would be entitled to copyright therein. Between these two rights Mr. Macfie is most anxious to show a broad line of demarcation, so broad, indeed, that he would wish the Copyright Act to remain undisturbed. Why of course he would. It is only throwing a sprat to catch a mackerill. What on earth do the monied aristocracy care about literature? What manufacturer or trader ever became rich by scribbling? But Patents—*they* affect their mills and all classes of manufactures; and their abolition would effectually smother that particular species of competition which ingenuity is continually introducing.

These remarks embody the sentiments Mr. Dircks expresses, his whole object being to show that patent law, although imperfect, can and may be considerably improved; and that the outcry against any attempt at any such improvement comes from a "small but influential" party—interested in keeping manufactures as they are, or only admitting slight and easily introduced improvements at remote and convenient periods.

The speakers in favour of the views expressed by Mr. Dircks were Messrs. F. P. Fellows, H. G. Bohn, R. Wilkinson, W. Weldon, F. J. Bramwell, W. Hancock, C. W. Siemens, and Mr. T. Webster, Q.C. The dissentient speeches were those of the Rev. Dr. Ginsburg and Prof. J. E. Thorold Rogers. The discussion appears to have been a very animated one, no other subject being before the section. At its conclusion a vote of thanks to the Chairman, the Right Hon. Sir Stafford H. Northcote, Bart., M.P., having been proposed and seconded, was responded to in a short address allusive to the present and entire proceedings of the week.

As Mr. Dircks remarks—"The public, the millions, have a greater interest at stake in the maintenance of patent law than they are aware, because its importance has not hitherto been brought under public notice." And as he states—"The whole scheme (of patent law abolitionists) is the attempt of wealth to crush the inventive talent of the country, or to transport it to other regions." To say the least, the course of those who assail patent law to exterminate it, shows a thorough absence of all national ambition; their only ambition being that grovelling one that marks the greed for gold, independent of all higher, nobler, and more civilising considerations. We are of opinion, therefore, that the perusal of the present pamphlet cannot fail to disseminate much useful information on the increasingly important subject of Patent Law.

ELECTRIC LIGHT.—Prof. FLEEMING JENKIN, of the University of Edinburgh, has patented some improvements in apparatus for producing electric light, especially applicable to beacons and buoys, which, by its use, may be conveniently lighted by a voltaic battery placed on shore, and communicating with the buoy or beacon by a submarine cable. The light is produced by a rapid succession of sparks, due to successive charges and discharges of a condsnser charged directly from a voltaic battery, without the intervention of any induction coil. When the invention is used for this purpose the condenser is on the beacon, and the battery on shore is connected with a terminal on the beacon by a submarine cable or aerial wire. The condenser is charged and discharged by a tongue or contact maker moving backwards and forwards between the battery terminal and an earth terminal. A somewhat similar plan has been adopted with a Ruhmkorff induction coil, but the new apparatus dispensing with the induction coil is less likely to get out of order, and converts a considerably larger proportion of the energy of the battery into light. The motion of the tongue may be produced by clockwork driven by a spring, which might be wound up in some cases by the motion of the buoy or beacon, as self-winding watches are wound. The motion of the tongue might also be produced by currents sent from shore through a second wire, which would move the tongue by an electro-magnet, as the tongue of a relay is moved in the usual Morse instruments; the tongue might also be moved by the motion of the buoy in some cases, and the tongue might also be worked in a manner analogous to the trembleur of the ordinary bells. In order to prevent the contacts where the sparks pass from wearing away too rapidly, the contact pieces may be made to revolve slowly, so as to distribute the action over a large surface. This motion may also be produced by the motion of the buoy or beacon when floating. The charges and discharges of a simple condenser are applied to the production of the electric light for other purposes. When the invention is in connection with buoys or beacons, it is not essential that the condenser and contact maker should be on the buoy or beacon, as the spark can be sent through a considerable length even of a submerged cable. The spark may also be made to spring across a partial vacuum.

THE NEW STEAM-BOILER.—A new invention has been so far perfected as to warrant its submission to the public for trial. Mr. Silas C. Salsbury, an old inventor and scientific student, has been devoting his attention untiringly in Germany and France to the development of a patent steam-boiler, by which the following effects may be obtained: economy of fuel; saving of room; rendering an explosion impossible; preventing incrustation; rendering it impossible to overheat the fire surface; increasing the intensity of the heating surfaces, as well as in extent; and utilising the gases. First, in regard to economy of fuel. By having the coldest water coming rapidly in contact in small quantities between the two hot plates under such a pressure as to cause a circulation from the main boiler to the water arch. This arch is surrounded on both sides by intense heat, and the circulation is increased in velocity just in proportion to the amount of heat in the furnace, by blast or otherwise; and as the circulation increases in velocity it brings the colder water in contact with the hot plates, which absorbs the heat as fast as produced, and the water so becomes highly heated. It is then discharged in the chamber above the water line in form of wet steam, and as it is driven in all directions among the tubes, they again supply the heat to fully prepare the steam dry for use. By this process an equalised temperature throughout all parts of the boiler is kept, absorbing all the heat as fast as it can be produced. There is a second chamber, in which the carbonic oxydes are utilised and changed to carbonic gases, supplying an intense heat above the water arch and thence up through the main boiler, which gives a larger and intenser fire surface. The supply of hot water to the upper chambers of the main boiler (which is fitted with 5 feet 2 in. tubes) is so distributed in jets by

contact throughout all the space above the water that overheating is impossible. The whistle is so connected with the lowest gauge cock that an alarm is given when the water reaches that point, and as it would take 1½ hour for the 20 in. below to evaporate, this length of time is given for escape from any possible danger. The space required for the boiler is less than one-half of that of any other. Incrustation is prevented by rapid circulation. The boiler possesses many other commendable features. Recently one was operating the iron works of Cohanks and Theall, and with 50-horse power was driving all their works, and at the same time was blowing off as much steam as was used. The valuable parts of this invention can be attached to other boilers.—*New York Tribune.*

## MINERAL PRODUCE OF CORNWALL AND DEVON.

BY MR. ROBERT HUNT, F.R.S.

[Read at the Miners' Association of Cornwall and Devon.]

My purpose is to bring before the members as correct a statement as it is possible to make of the mineral produce of the two western counties, and to show the relation of this production to the total demands of our manufacture, as shown by our imports and exports. During the past ten years our production of tin has been as follows:—

| | Tin ore. | | | Metallic tin. | |
|---|---|---|---|---|---|
| | Mines. | Tons. | Value. | Tons. | Value. |
| 1859 | 128 | 10,180 | £738,488 | 6497 | £ 850,452 |
| 1860 | 143 | 10,400 | 812,160 | 6656 | 866,306 |
| 1861 | 148 | 10,963 | 793,698 | 7016 | 857,706 |
| 1862 | 147 | 11,841 | 777,396 | 7578 | 879,048 |
| 1863 | 171 | 14,224 | 943,387 | 9104 | 1,065,168 |
| 1864 | 174 | 13,985 | 881,031 | 9295 | 995,029 |
| 1865 | 156 | 14,122 | 782,284 | 9038 | 872,659 |
| 1866 | 145 | 13,785 | 667,999 | 8822 | 781,849 |
| 1867 | 117 | 11,066 | 549,375 | 7296 | 670,228 |
| 1868 | 109 | 11,584 | 641,137 | 7703 | 756,494 |

The highest mean average price of block tin in any year was in 1857, when it was 76*l.* per ton. In 1859, the price was 74*l.* 15s., from which point it gradually declined, until in 1866 the mean average price was 48*l.* 10s.; the lowest point reached in 1867 was 50*l.* 18s., and in 1868 55*l.* 4s. During the past year the lowest price was in June, 47*l.*; and the highest in December, 63*l.* 5s. In 1868 our imports of tin amounted to 5625 tons, and of tin ore and regulus to 470 tons, while we exported of "foreign tin" 1105 tons, and of British tin 4061 tons. The production of the Dutch mines for the five years had been:—

| | Banca tin. | Billiton tin. |
|---|---|---|
| 1864 | Tons 4907 | Tons 630 |
| 1865 | 4182 | 845 |
| 1866 | 4807 | 925 |
| 1867 | 4260 | 1857 |
| 1868 | 3636 | 1708 |

From this it appears that at the same time as there has been a falling off in the production from the island of Banca, there has been a steady increase in the quantity of tin produced in the island of Billiton. Copper—In 1859 Cornwall produced from 98 mines 146,093 tons of copper ore, the average price of which was 5*l.* 17s. 6d. per ton, giving a produce of 6¾. The production, prices, and produce of the last five years were as follows in Cornwall:—

| | | Tons of ore. | Average. | Produce. |
|---|---|---|---|---|
| 1864 | 173 mines produced | 127,633 | £5 3 0 | 6¼ |
| 1865 | 148 " " | 121,253 | 4 18 0 | 6⅛ |
| 1866 | 130 " " | 103,670 | 4 11 0 | 6⅛ |
| 1867 | 109 " " | 88,603 | 4 7 0 | 6⅛ |
| 1868 | 100 " " | 86,722 | 4 11 0 | 6⅛ |

For the same period the mines of Devonshire produced as follows:—

| | | Tons of ore. | Value. |
|---|---|---|---|
| 1864 | 19 mines produced | 37,987 | £194,197 |
| 1865 | 21 " " | 38,156 | 184,776 |
| 1866 | 21 " " | 34,471 | 151,481 |
| 1867 | 23 " " | 31,163 | 143,898 |
| 1868 | 20 " " | 30,540 | 128,748 |

The relation which this bears to the copper produced from other mines in the United Kingdom and the foreign and colonial copper imported will be seen from the following table for the year 1868:—

| | Ore and regulus. | Copper. |
|---|---|---|
| Total copper ores of United Kingdom | Tons 157,335 | Tons 9,817 12 |
| Regulus and precipitate sold in Cornwall | 830 | 48 0 |
| Colonial and foreign ores sold at Swansea ticketings | 19,158 | 3,539 9 |
| Colonial and foreign ores not sold at ticketings | 64,176 | 10,690 0 |
| Regulus and precipitate sold at Swansea ticketings | 723 | 291 13 |
| Colonial or foreign regulus and precipitate not sold at ticketings | 29,979 | 9,500 0 |
| Pyrites producing copper | 213,655 | 4,250 0 |
| Total quantity of copper smelted in England | 485,856 | 28,136 14 |

The last item of this table demands some attenton. In 1868, 213,655 tons of sulphur ores were imported into this country, the value of which was 527,954*l.* It is estimated that about 4250 tons of copper ore were obtained from these pyritic ores, 2600 tons having been manufactured at the copper precipitating and smelting works on the Tyne, the remainder at Liverpool, Glasgow, and in Staffordshire. The imports of these ores into the Mersey in 1868 were—from Pomaronia (Spain), 47,362 tons; Huelva, 17,385; Seville, 1060; Corunna, 2182; Vixones (Norway), 370; Stavanger, 270, 68,579 cupreous pyrites; Drontheim, 10,380; Rotterdam, 510, 10,890 without copper: total, 79,469 tons. Of this importation there is every promise of there being a very large increase. The ore yields sulphur to the sulphuric acid manufacturer, copper to the precipitating works, and the oxide of iron left by the process is sold as "purple ore" to the iron works, and is extensively used for "fettling" puddling-furnaces, while some is converted into iron in the blast-furnace. Of lead ore Cornwall produced in 1868, from 17 mines, 8415 tons of lead ore, yielding 6310 tons of lead, and 303,033 ozs. of silver; while Devonshire, from two mines, produced 1552 tons of lead ore, yielding 1141 tons of lead, and 39,865 ozs. of silver—the total produce of the United Kingdom, from 226 mines, being 94,952 tons of lead ore, which gave of lead 70,768 tons, and 835,542 ozs. of silver. Our total imports of lead ore in the same year were 11,882 tons, and of pig and sheet lead 49,461 tons. Our exports of British lead were—Of pig lead, 33,697 tons; rolled and sheet, 5577; piping, 2281; shot, 2330; red lead, 3800; white lead, 5193 tons. The production of zinc ores (blende—black Jack) in Cornwall and Devonshire had not been large. Cornwall produced 2061 tons, valued at 5496*l.*; Devonshire, 69 tons, at 172*l.*; the total production of the zinc ores of the kingdom being about 12,000 tons, leaving a value of about 36,133*l.* 10s. Of iron pyrites (mundic) Cornwall sold, during 1868, 7357 tons, and Devonshire, 685: the total produce of the United Kingdom being 76,484 tons, of the value of 53,536*l.* Of manganese, Devonshire and Cornwall produced and sold last year 1700 tons, of the value of 7650*l.* Of iron ores, Cornwall brought into the market and sold 8310 tons, of the value of 2460*l.*; and Devonshire produced 11,178 tons, of the value of 3667*l.*, a very small proportion out of the vast production of other parts of the kingdom, the total production of iron ore being 10,168,731 tons, of the value of 3,196,600*l.* The following is a general summary of the metallic ores produced in Devonshire and Cornwall, in 1868:—

| | | |
|---|---|---|
| Tin ore | Tons 11,584 | Value £641,137 |
| Copper | 117,262 | 501,753 |
| Lead | 9,937 | 34,779 |
| Zinc | 2,130 | 4,669 |
| Pyrites | 8,032 | 7,553 |
| Manganese | 1,700 | 7,650 |
| Iron ores | 19,488 | 6,328 |
| Ochres, &c. | 2,500 | 2,358 |
| Arsenic | 1,740 | 6,410 |
| Wolfram, fluor-spar, and sundries | 160 | 250 |
| Total | 174,533 | £1,213,887 |

Such is the real value of the metalliferous minerals produced in 1868 from the mines of Cornwall and Devonshire before any charges had been incurred for their transport from the place of production. And it must be remembered that neither porcelain clay, china-stone, granites, slates, nor other building stones are included in this. When we carefully examine the condition of our imports, whether of tin, copper, lead, or zinc, it must become evident that the mineral producer of Cornwall and Devonshire has in the future a severe race to run with the foreign and colonial adventurers in those mineral fields which are now being largely developed by their own sons. That race can only be run with any chance of success by calling to the miners' aid all the approved appliances which knowledge has given to us, whether derived from experience or gained by a systematic study of science. If time had permitted, it was my intention to have shown in what way the aids of science may be brought to serve the great mining interests of the country. It does not. I am, therefore, compelled most reluctantly to leave what I had to say on this unsaid for a season. I know that amongst our miners there is a full appreciation of the value of that knowledge which the Miners' Association offers them, but there is much doubt if the benefits of such knowledge can be continued, especially to the same beneficial extent as at present, unless the counties of Cornwall and Devonshire can be brought to see more evidently than they do the force of the truth that the future of mining depends entirely upon the aids it may receive from science. (Applause.)

Mr. Charles Fox remarked that, with respect to the production of copper, he believed that in some parts of the world it had fallen off considerably. For instance, mines in the States of Connecticut and New Jersey did produce a large quantity of rich ores, principally at the junction of the sandstone and granitic and gneiss rocks, but were now abandoned. Lake Superior still produced somewhere about 10,000 tons per annum, but he was inclined to believe that several of the mines there were worked at a loss. He quite agreed with the opinion they had just heard expressed by the Chairman and Mr. Hunt, that it was most incumbent upon them, if they would run a race with other countries, to adopt every improvement which science or practical skill could suggest in their mines. They must economise to the utmost the cost of raising and dressing, and also in working the mines themselves. He had had a conversation with Mr. Warington Smyth since the opening of the Polytechnic Exhibition on this subject, and that gentleman had told him that on recently visiting the mines in the Hartz Mountains he was astonished with the extent and efficiency of the appliances and arrangements which had been provided for the dressing of the ores. The cost of the buildings could not have been less than 80,000*l.* With respect to the future price of copper, he took a more cheering view than many persons, from the circumstance that the increase in the consumption of that metal had been in ten times greater ratio than the increase in the population; and, moreover, when they looked at the railways which had been planned by the Indian Government, and which, no doubt, would be carried out, he believed these in themselves would consume a large quantity of copper, and that indirectly would give such a stimulus to the commerce of India as to increase its consumption in other ways. Then, again, he looked to the once slave States of North America. Not less than fifty millions annually were paid in those States for cotton, and a large portion of that—in many instances one-half—went to the free men, who were certainly more likely to spend it in articles of necessity than in mere luxury. Again, how enormous was the waste of copper. They knew that people took care of gold with quite as much care as they did of their own souls, and yet he had the official report presented to him by the American Consul from the Government of the United States, in which it was estimated that the waste of gold in the United States alone since 1848 had not been less than twenty millions sterling. The waste of copper, of course, went on at a much more rapid rate. Referring to the alleged waste of tin in some of the Cornish mines, he doubted if that waste amounted to more than a thousandth part of that which ran into the sea, the value of which he should not take at more than 15d. per ton of waste. Now, he held that it would be impossible by the application of labour to pay for taking out that small quantity of tin. They knew that there was waste in many things. Every spring-tide there was a great waste of salt from that harbour, amounting, he would venture to say, to three millions in value yearly, but no one thought of collecting it. Recently an interesting experiment was witnessed by several persons—that of grinding the tinstuff instead of stamping it. He understood that a ton of tinstuff was ground by the mill in an hour, at the cost of 8d., which was about the same as it would cost in stamping. It was a question whether the cost of working 24 heads of stamps was greater or less than would be the cost of driving these millstones. Another consideration also was whether some soft description of tin ore would not suffer by being reduced to such an impalpable powder as it would be on being ground between the millstones. Still, it might be found advantageous occasionally to employ these mills for crushing tinstuff instead of stamps, on account of the less space which they would occupy; but these were matters which would have to be decided by practical experience. In conclusion, Mr. Fox referred to the progress that was being made with boring-machines, and by expressing a hope that the existence of the Miners' Association would not be allowed to close for want of contributions.

## MANUFACTURE OF IRON AND STEEL.

Mr. James Palmer Budd, of Ystalyfera, near Swansea, in specifying the particulars of his invention, says:—

"Heretofore it has been proposed to refine and decarbonise cast-iron by stirring in therewith nitrate of soda, or, as in what is known by the Heaton process, by running it in a molten state into a deep vessel, at the bottom of which a cake or block of nitrate of soda is placed, and such cake or block is prevented from rising by a perforated false bottom placed above it.

Now, according to my invention I subject fluid cast-iron to the action of nitrate of soda in flat shallow pans or vessels of cast-iron (similar to the moulds used with refinery furnaces, only without a water bosh beneath them), capable of holding from 4 to 5 in. in depth of melted metal, and which are by preference about 16 feet long, and from 2 to 3 feet wide. The nitrate of soda I employ together with soft hæmatite iron ore, which if not sufficiently free from grit I pass through a pair of clay rolls, so as to bring it into a plastic state, the two being mixed together and moistened with water to form a paste, and with this paste I coat the bottom and sides of the converting vessel or pan, and the vessel being hot from previous use quickly dries up the paste, and is then ready to have molten iron run into it from a blast or remelting cupola or refining furnace. The converting vessel or pan should be placed as near as practicable to the blast or other furnace used to supply the molten iron, in order that the iron may not become cooled in its passage from one to the other. When the metal is poured into the vessel the nitrate of soda or potash is vapourised, but being mixed with the soft hematite ore not suddenly or explosively, and by passing through the thin stratum of iron removes from it any phosphorus or sulphur it may contain; it also largely decarbonises the iron. I would state that other substances, such as loam and clay, might be mixed with the nitrate of soda or potash to form a paste with, it and to retard its vaporisation when acted upon by heat; but I prefer to employ soft hematite ore, as it will part with its oxygen to combine with the carbon of iron, whilst the iron contained in the hematite will become incorporated with the general mass. Oxide of manganese, iron scale, or other substances capable of yielding oxygen when exposed to heat might be used with loam or clay in place of the soft hematite ore, or these substances might be used together with the hematite ore. The extent to which the decarbonising process is carried on will mainly depend on the thickness of the coating of nitrate of soda and Lancashire ore, and the metal may thus be brought into the state of refined metal, or it may be carried on until the metal is brought into a semi-converted iron or crude steel, in a honeycombed slab or mass. When I want only to remove the phosphorus and sulphur in the molten iron without much decarbonisation, I only put a thin coating of nitrate of soda, soft hematite ore, clay, or other retarding substance, and spread the nitrate loosely on the surface, taking care not to employ so much as to become explosive, as in that case the iron gets dispersed, and it is dangerous for the workpeople. This slab or mass I afterwards break up when cold and remove it to the puddling furnace, where it is gathered together in a pasty state into balls. That part of the puddling process which consists of melting the pig and rabbling it for decarbonisation is saved if the process of decarbonisation has been carried sufficiently far in the converting vessel or pan. A greater amount of work can thus be done in a puddling furnace, whilst less coal will be consumed, and the sides and bottom of the furnace will be but little acted on; a much better yield will also be obtained, and the quality of the malleable iron improved to a great extent. If the decarbonisation has been carried sufficiently far in the converting vessel or pan I remelt it in a Siemens or other suitable furnace, together with scrap, if necessary, to obtain cast-steel."

## FOREIGN MINING AND METALLURGY.

The want of rolling stock on the Belgian lines continues to be a great source of grumbling in the Belgian coal basins. Complaints have arisen on all sides on this subject, and it does not seem at present that the least attempt has been made to improve a state of things which has occasioned considerable injury to the Belgian coal trade. Some attention has been directed of late to the best means of facilitating the exportation of Belgian coal *via* Antwerp; it does not appear at present, however, that English coal owners have much reason to fear Belgian competition in the supply of over-sea markets. A new goods tariff has come into force this month with reference to the conveyance of goods between Belgium and the North and Centre of Germany. A report has obtained currency that three of the great Belgian works have secured a large contract for iron sleepers on Egyptian account; this piece of intelligence requires, however, further confirmation. However this may be, the attitude of Belgian industrials seems to indicate that they are quite contented and confident as to the approaching season, and several establishments are still extending their means of production. Thus, the South of Charlerol Company is building a new blast-furnace, and the Marcinelle Company another. Prices are maintained at a higher rate; thus, No. 1 iron is quoted at 6*l.* 16s. to 7*l.* per ton. Ordinary refining pig is quoted at 3*l.* per ton, while casting pig has risen to 3*l.* 10s. per ton.

The quantity of coal and coke imported into France in May was 332,780 tons, as compared with 363,972 tons in May, 1868; in the five months ending May 31 this year the aggregate imports of coal and coke into France amounted to 1,621,111 tons, against 1,593,825 tons in the corresponding period of 1868. The quantity of imported coal and coke delivered for consumption in France in the first five months of this year was 1,539,690 tons, against 1,512,152 tons in the corresponding period of 1868. The quantity of iron and iron minerals imported into France in May was 79,889 tons, as compared with 72,085 tons in May, 1868; and in the first five months of this year 308,392 tons, against 253,833 tons in the corresponding period of 1868. The quantity of imported iron and iron minerals delivered for consumption in France in the first five months of this year was 224,676 tons, against 188,229 tons in the corresponding period of 1868. The quantity of coal and coke exported from France in May was 36,515 tons, as compared with 31,439 tons in May, 1868; and in the five months ending May 31 this year 266,912 tons, as compared with 158,528 tons in the corresponding period of 1868. The quantity of French coal and coke exported from France in the first five months of this year was 84,267 tons, as compared with 81,301 tons in the corresponding period of 1868. The quantity of iron and iron minerals exported from France in May was 42,393 tons, as compared with 35,122 tons in May, 1868; and in the five months ending May 31 this year 147,228 tons, against 104,688 tons in the first five months of 1868. The quantity of French iron and iron minerals exported from France in the first five months of this year was 84,514 tons, as compared with 86,010 tons in the corresponding period of 1868.

The metallurgical market of the Haute-Marne (France) has not presented any very interesting feature of late. Upon the whole, the state of affairs remains much the same; at the same time there is, perhaps, a slight slackening in the demand. The drought has terminated, but the state of the local navigations has not much improved; at Rheims, for instance, boats of 150 tons have been stopped. It is hoped that in a few days the navigations will resume their regular course. Special irons, sheets, and machine iron are a good deal sought after. There has been little doing in coke-made pig for some time past; on the other hand, charcoal-made pig has given rise to some transactions, and a quotation of 4*l.* 4s. per ton is easily obtained; mention is made of a contract concluded recently on these terms. The foundries have heavy orders to execute; some of them have received orders for heavy castings, which are usually executed by works of the eastern group, which are at present overdone with work. The liquidators of the Imphy and St. Seurin Steel Works Company, by virtue of powers given them by the shareholders assembled at a general meeting, which decided on the dissolution of the company, have just transferred the works of the undertaking to another joint-stock enterprise, known under the name of MM. Boigues, Rambourg, and Co. The consideration for the transfer is 945 shares in MM. Boigues, Rambourg, and Co. In consequence of the opening of several new sections, which have somewhat changed the course of traffic, the Eastern of France, the Northern of France, and the Western of France Railway Companies have adopted a new combined tariff for the conveyance of certain metallurgical products *via* Laon and Cleres. The Commentry Collieries and Fourchambault, Montlucon, Torteron, and La Pique Forges and Foundries Company commenced the payment yesterday (Oct. 15) of the balance of the dividend of 1868, or 14s. per share. The Marseilles Gas Lighting and Blast Furnaces and Foundries Company (with which undertaking is associated the Portes and Sénéchas Mines) has been paying this month the balance of the dividend for 1868, or 11s. 5d. per share.

The Creusot works are said to have now orders on hand to the amount of upwards of 100,000 tons.

With regard to the sale of tin by the Dutch Society of Commerce, we learn that Banca made 74 fls., and Billiton 74 fls. to 74¼ fls. These prices, which were much below the rates anticipated, attracted a lively demand for consumption, and the English market remaining firm, Banca has been carried at Rotterdam to 76¼ fls. At this price, however, some realisations have taken place. In Billiton little business has been done, and holders have refused to do business at rates below those current for Banca. The position of the article appears at present favourable. At Havre, Banca has been quoted at 140*l.*; Straits, 136*l.* to 140*l.*; and Peruvian, 100*l.* to 112*l.* At Paris, Banca has made 138*l.*; Straits, 137*l.*; and English, 124*l.* At Antwerp, Banca has made 84 fls. to 85 fls. per cwt. There has been but little change in copper. At Havre, Chilian in bars has made 69*l.* 8s. to 70*l.*; refined ditto, in ingots, 76*l.* to 78*l.*; Peruvian mineral (pure standard), 72*l.*; United States, Baltimore, 76*l.* to 78*l.*; ditto, Lake Superior, 80*l.* to 86*l.*; ditto Mexican and La Plata, in bars, 66*l.* to 68*l.* At Marseilles, Toka in warehouse has realised 72*l.*; and Spanish, for consumption, 70*l.*; while refined Chilian and Peruvian have brought 74*l.* per ton. Lead has been generally a trifle lower. There has not been much doing in zinc, but a revival in affairs is anticipated shortly.

Coal in the North of France.—He who for some time has not travelled in the North of France, on the road from Lillers to Amiens, would find a pleasing contrast between what that part of the country then was and what it now is; indeed, about ten years ago it was bare and deprived of any industry whatever, whilst at present, besides the numerous manufactures already in existence, day after day new and important works are making their appearance, thus spreading wealth all around. Such a happy change in the features and riches of this district is owing to the discovery of collieries in the Cauchy à la Tour coal field, bassin houiller du Pas-de-Calais. Among the mines from which coal is actually extracted the Coubronne Mine is well deserving of public attention; this pit is sunk to the depth of 300 yards. The seams run thus:—The Marie 4-ft. seam, the Léon 3-ft. seam, the Juliette 5-ft. seam, the St. Louis 4-ft. seam, and the Du Midi 3-ft. seam, besides two others which have not received special names. The Coubronne Mine is capable of yielding about 200 tons per day. The coal is of very good quality, and much in demand for the works in the neighbourhood, as well as for house fuel. Its exceptional situation, in proximity to railways and canals, make it a most valuable property.

## FOREIGN MINES.

Imperial Silver Quarries.—Extract of a letter received from Mr. Lewis Chalmers:—Sept. 20: There were 20 ft. of tunnel made last week. We are again in rock carrying sulphurets of the base metals, and nearing the outside of a line perpendicular from the east side of F F—say, 38 to 40 ft. therefrom. If the rock continues as it is I will soon rush through this. At the close of Saturday night's shift we had made 1137 feet.

Anglo-Italian.—According to Mr. Pearson Morrison's report for September, additional force has been added to some of the material points, including the new discovery, on account of the near approach of winter, and also to increase as much as possible the mineral supply to meet the requirement of the mills, &c., now drawing towards completion. For the first time stoping has been commenced at these places, efforts up to the present being exclusively confined to the increase of the exploratory works. These have not attained the desired extent, on account of the excessive hardness of the country rock, and for a short time will cause some irregularity as regards supply. But there is not the slightest cause for discouragement; the general advance during so short a space of time—16 months—is highly satisfactory, without mentioning the favourable increase of late in the produce throughout the mine. Towards the end of the year the monthly cost will be materially reduced, and though there may be a scarcity in the supply of ore for a short time, the increased produce will, Mr. Morrison hopes, to a great extent, make up the deficiency. There have been 73½ tons of mineral brought to the floors.

Capula.—Capt. Paull, Aug. 26: We are able to extract sufficient ore to meet the mine costs, and if we could have had all the metal reduced we should have been able to continue on some of the works of the hacienda. As the owners of the San Cayetano hacienda cannot reduce all the Capula ores, on account of their having a large supply of their own, and they not being yet in possession of San Diego hacienda, therefore I have arranged to send some metal to the hacienda of Jesus, at El Chico. The net proceeds from silver of torta No. 6 amounted to $2478 08c. Torta No. 7 I expect will be washed this week, from which I expect rather more silver than we had from No. 6. The assay is 21½ marcs per monton (129 ozs. to the ton). It has been delayed on account of the heavy rains. Torta No. 8, of 15 montons (mine assay, 22 marcs), is salted, and would have been incorporated ere this but for want of sulphate of copper. I expect 10 quintals from Mexico this week that ought to have arrived last. Torta No. 9, of 150 cargas, is now grinding (mine assay, 20 marcs). We have sent in 122 cargas for No. 10, which we shall complete this week, weather permitting. We expected to have sent 100 cargas this week for No. 11, but the heavy rains have prevented the carriers from coming.

Sept. 7: Torta No. 7, of 15 montons, was washed on 27th ult., and produced 284 marcs 2 ozs. (2274 ozs.) of silver, that will be sent to Mexico by to-morrow's conducta. Torta No. 8, also of 15 montons, was incorporated on 28th ult., which we expect will be washed in time for the next conducta. Tortas Nos. 9 and 10 are of 20 montons each. We are now sending metal for torta No. 11, and shall also commence sending to Jesus hacienda this week.

Cape Copper.—The detailed mining reports of Ookiep and Spectakel will as usual be forwarded by the regular monthly mail; but Captain Williams mentions that Spectakel Mine continues to improve, and he hopes to raise 300 tons for the current quarter, the portion already sampled averaging 35 per cent. Of Ookiep he writes: "The 40 fm. level, west and north, are both looking very well. The winze working below the 20 is looking splendid, and Job's rise in the back of the 20 on Job's branch is also looking splendid. The stopes are all holding their own and looking very well." He also forwards detailed reports of the trial mines, and writes: "I hope they will meet your approval. I think by the end of this quarter I shall have something better to report on from Roperberg and Nababeep." The superintendent writes:—"It is with much pleasure that I have to report favourably on the transport from the mines for the past month." It is also reported from the coast that rain in moderate quantities continues to fall. Transports from Aug. 1 to 28 amounted to 1050 tons. Bills of lading are to hand for 65 tons of copper ore per Briton (s.), and 120 tons per Celt (s.). The Earl of Mar and Kellie has been chartered in the colony to bring home not less than 550 tons, and the Glanrafon, 700 tons burthen, has been chartered here to follow the ships mentioned in last report: 370 tons of copper ore were sold on Sept. 21 by public ticket, at an average of 13s. 6½d. per unit.

Pestarena United.—Thomas Roberts, Oct. 8: Peschiera Mine: The stopes in the bottom continue the same as last week.—Aquavite: Since our last we have had a trial of the ore from the 33 fathom level end south, and find it to give fully 1 oz. of gold per ton; this end yields 7 tons per fm.—Val Toppa Mine: The end south, on the side lode, in No. 3 level, is not looking so well. The rise on this lode, and all points throughout the mines, are about the same as last week.

Lusitanian.—At Taylor's engine-shaft, below the 130, the lode is worth 2 tons per fathom for the length of the shaft—15 fms. In cutting plat at the 130 the lode is worth 2 tons per fathom. At the winze No. 79, below the 120, west of Taylor's, on Basto's lode, the lode is worth 1 ton per fm. We are sinking a winze below the adit level, west of River Caima, where the lode is 1½ ft. wide, composed of quartz and ½ ton of ore per fm.—Levels on Basto's Lode: In the 130, east of Taylor's, the lode is 4 ft. wide, composed of quartz and country. In the 130 west the lode is 1½ foot wide, composed of quartz and stones of ore. In the 120 east the lode is 2½ ft. wide, composed of loose runners of country and quartz. In the 120 west the lode is 1 ft. wide, composed of quartz. In the 110 east the lode is 1½ foot wide, composed of flookan. In the 90 east the lode is 1½ ft. wide, composed of flookan. In the 70 east the lode is 3 ft. wide, composed of quartz and flookan. In the 70 west the lode is 6 in. wide, composed of country and quartz. In the 28, west of cross-cut, west of Perez' shaft, the lode is 6 in. wide, composed of country. In the 28 east the lode is 1¼ ft. wide, worth 1½ ton of ore per fm. In the 18, west of cross-cut, west of Perez', the lode is in two distinct branches, having a piece of country between them 6 ft. wide, worth ¾ ton per fathom.—Carvalhal: In the rise No. 1, above the 40, east of incline, the lode is worth 2 tons per fathom. In the 50, east of incline, on great lode, the lode is 1½ foot wide, composed of quartz. In the 50 west the lode is 2 feet wide, composed of quartz and stones of blende. In the 40 east the lode is 4 feet wide, composed of quartz and lead, worth 1½ ton per fathom. In the 30 east the lode is 1 foot wide, composed of flookan, and a little quartz. In the 20 east the lode is 1½ foot wide, composed of quartz. In the 10 east the lode is worth 1½ ton per fathom. In the 10, west of incline, the lode is 2 ft. wide, composed of quartz, mundic, and lead, worth ½ ton per fm. In the deep adit, west of River Caima, the lode is 2½ feet wide, composed of quartz, with stones of mundic and lead.

Rhenish Consols.—Oct. 9: We have, I believe, the footwall of the lode in the cross-cut near the western end, in the adit level at Christiania, and there are good ribs of lead in the lode, which is presenting a very good appearance. By the setting list you will see that we have a winze sinking from the bottom of the adit level, 30 lachters west of the air-shaft, on the north lode at Bleibach; and a rise started from the roof of the 10, to communicate with the winze; 2 ft. above the level the lode has greatly improved, and will afford 20 centners per lachter.—Madonna: The water has been drawn out of the shaft, and some splendid lumps of lead extracted from the lode and brought to surface, some lumps being fully 100 lbs. weight, and almost solid lead; but the water is so heavy that we find it impossible to keep it with horse-power, consequently the horse-engine is now idle, and we have come to the conclusion to remove Fahrenberg engine and erect it at once.

[For remainder of Foreign Mines see to day's Journal.]

A quicksilver mine, which was discovered near the town of Sarawak (Borneo) in 1867, promises to prove one of the richest in the world. A trial shipment of native ore has been found by analysis to contain 70 to 80 per cent. A very promising coal field has been discovered in the Linga district, but no arrangement has yet been made for working it.

"Ten Pounds for a Newspaper."—In the *Times*, a few days since, the following appeared:—"Ten Pounds Refused for a Newspaper.—Extract of a letter from a passenger by the Tycho Brahé steamer, which sailed from Liverpool for Shanghai on July 15, dated Table Bay, Aug. 14, 1869:—'We are now at anchor in Table Bay, off Cape Town. We sail again to night. Lovely weather. We have beaten the mail boat, which left Southampton five days before us, and I have a whole squad of fellows copying my *Times*. One offered 10*l.* for it, but I had refused a lot of offers before, so I am going to keep it; others have placed their boats at my service for being allowed to copy.'" We have now to add that the screw-steamship Tycho Brahé was built in 1867, by Messrs. Andrew Leslie and Co., of Hebburn Quay, on Tyne, was supplied with compound engines by Messrs. Robert Stephenson and Co., of Newcastle-on-Tyne, and the circulating pumping-engines were supplied by the well-known firm of Messrs. John and Henry Gwynne, of Hammersmith, London, for Messrs. Lamport and Holt, of Liverpool, who are owners of a large fleet of similar steamers, trading between that port and China. The voyages are uniformly speedy and successful, and the consumption of fuel is remarkably small; contrasting very favourably with the results obtained by steamers of the Royal Navy, and those of the principal steamship companies.

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